RCRA FACILITY INVESTIGATION PROPOSAL
CIBA-GEIGY FACILITY
CRANSTON, RHODE ISLAND

VOLUME 5 OF 6

PUBLIC HEALTH AND ENVIRONMENTAL RISK EVALUATION, MEDIA PROTECTION STANDARDS AND CORRECTIVE MEASURES RISK EVALUATION WORK PLAN

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SECTION 1
INTRODUCTION

1.1 PURPOSE

The purpose of this work plan is to describe the work that will be conducted to evaluate the potential human health and environmental risks associated with potential exposure to hazardous waste and/or hazardous constituents possibly released from the Solid Waste Management Units (SWMUs) and Areas of Concern at the CIBA-GEIGY facility in Cranston, Rhode Island (the facility or the site). Definitions of the SWMUs and Areas of Concern are included in Volume 1 - Investigation Work Plan. In addition, this work plan presents the criteria that will be used to prepare the Media Protection Standards (MPS) Proposal and describes the work that will be conducted for the corrective measures risk evaluation.

1.2 APPROACH

This work plan is divided into three major sections:

- Public Health and Environmental Risk Evaluation (Risk Evaluation) work plan;
- Media Protection Standards (MPS) work plan; and
- Work plan to evaluate potential health and environmental impacts due to the implementation of corrective measures that will be developed in the Corrective Measures Study (CMS) Report.

These work plans incorporate applicable approaches for health and environmental risk assessments as presented in the following documents:

- The Superfund Public Health Evaluation Manual (SPHEM) (EPA, 1986)

- The Superfund Exposure Assessment Manual (EPA, 1988)

- EPA Region 1 DRAFT FINAL Supplemental Risk Assessment Guidance for the Superfund Program: Part 1 - Supplemental Guidance on Superfund Public Health Risk Assessments: Part 2 - Guidance for Ecological Risk Assessments (EPA, 1989)

- The Administrative Order on Consent (Order) No. I-88-1088, issued to CIBA-GEIGY (1989).

SECTION 2
PUBLIC HEALTH AND ENVIRONMENTAL RISK EVALUATION WORK PLAN

2.1 APPROACH

The Risk Evaluation has been designed to meet, at a minimum, the following requirements of the Order:

- o Identification of any chemical source terms (e.g., SWMUs) and affected media at the facility;
- o Selection of indicator chemicals;
- o Estimation of exposure point concentrations in relevant media;
- o Comparison of exposure point concentrations to relevant exposure guidelines; and
- o Integration of risk (e.g., comparing intake levels to health-based criteria).

2.2 BACKGROUND INVESTIGATION

Before conducting the Risk Evaluation relevant data will be gathered during a site visit and reviewed. Information will be obtained concerning:

- o The background of the site;
- o Disposal histories;
- o On-site and off-site chemical analysis data;

- o Topography, hydrology and hydrogeology of the area; and
- o Demographics and environmental settings.

Existing chemical characterization data for the facility will be reviewed for inclusion into the Risk Evaluation.

Sampling efforts and chemical characterization of on-site areas, the Off-Site Area, and the Pawtuxet River Area for Phase I are addressed in Volume 1 - Investigation Work Plan. The Facility Investigation is designed to ensure that the Sampling and Analysis Program will satisfy the data requirements of the Risk Evaluation.

2.2.1 Source Term Characterization

2.2.1.1 Solid Waste Management Units and Areas of Concern. The characterization of potential chemically affected areas of the facility will be conducted as detailed in Volume 1 - Investigation Work Plan. The Sampling and Analysis Program for the SWMUs and Areas of Concern will address:

- o Soil;
- o Ground water;
- o Surface water; and
- o Sediment.

The site was razed in 1986; therefore, air will not be sampled. However, air will be evaluated as a potential migration and exposure pathway in the Risk Evaluation.

2.2.1.2 Off-Site Characterization. The characterization of potential chemically affected off-site areas will be conducted as detailed in Volume 1 - Investigation Work Plan. The media to be sampled and analyzed are:

- o Soil;
- o Surface water; and
- o Sediment.

Specified schools and nursing homes listed in the Order and other public use facilities will be investigated as part of the off-site characterization.

2.2.2 Environmental Receptor Investigation

The objective of the environmental receptor investigation is to characterize environmental receptors potentially affected if chemicals from the facility are being released to the environmental media. The following tasks will be undertaken as part of this investigation as suggested by EPA Region 1 (EPA, 1989):

- o Review available background information;
- o Perform a site reconnaissance by a field biologist; and
- o Identify potential chemically affected indicator species and habitats;

The facility is located along the north and south banks of the Pawtuxet River in Cranston and Warwick, Rhode Island, respectively. Initial review of site data indicates that the river biota possess the greatest potential for environmental impact due to possible chemical releases from the SWMUs and Areas of Concern. Therefore, the primary focus of the environmental receptor investigation will be on the characterization of the biota in the Pawtuxet River by conducting a Screening Level Assessment (EPA, 1989). The Screening Level Assessment consists of bioassays conducted in a tiered approach as outlined in Figure 2-1. These bioassays will consist of acute 48-hour toxicity testing using Daphnia species as an indicator of water quality (EPA, 1985). EPA Region 1 supplemental guidance concerning ecological risk assessments, and personal communications with EPA (CIBA-GEIGY, 1989) have been used to develop this tiered approach to the bioassays.

Using appropriate reference sources, information will be collected on the indigenous flora and fauna in the area of the facility. Endangered species will be included. Both flora and fauna will be considered as potential on-site environmental receptors because any evidence of potential environmental stress will be most evident on or immediately adjacent to the facility. In addition, wild game will be considered as a potential exposure pathway.

2.3 INDICATOR CHEMICAL SELECTION

The site-specific indicator chemicals will be selected from:

- o Detected Appendix IX compounds;
- o Detected Targeted Compound List (TCL) parameters; and
- o Detected chemicals unique to the facility and not listed on Appendix IX, which will be referenced as "fingerprint" compounds.

2.3.1 Selection of Fingerprint Compounds

The following section describes the procedure by which fingerprint compounds will be chosen. Fingerprint compounds are compounds specific and unique to activities which occurred on the facility. The selection of fingerprint compounds is not a requirement of the Order but has been incorporated into this work plan to ensure a more complete investigation.

The selection of fingerprint compounds will be determined through:

- o The review of chemical production and usage records to identify those that are unique to the facility;

- o The toxicology of these chemicals;

- o Physicochemical properties, including the potential for degradation, volatility, and transport; and

- o Review of existing chemical analyses of the environmental media surrounding the facility.

2.3.2 Target Chemical Selection

Appendix IX compounds, TCL parameters, and the fingerprint compounds form the initial list of all chemicals to be sought. The environmental media samples will be analyzed for these chemicals. After the first round of sampling and analysis for these chemicals is completed, the results of the chemical analyses will be reviewed for chemicals which may be dropped from further consideration. Those remaining on the list will be referred to as "target chemicals." The term "target chemical" is not a defined term used by EPA, but is used in this report to refer to those chemicals which will be considered for selection as indicator chemicals. The following guidelines are proposed for eliminating chemicals:

- o The chemical was not detected in any of the media samples;

- o The chemical was detected in only one medium of all sampled media, and was within one magnitude of the detection limit; and

- o The chemical was detected in one or more media, but is at or below the background levels (from samples taken at designated background locations) for that specific medium.

These guidelines are proposed so that resources may be focused on further characterization of the chemicals in the various media during Phase I sampling and analysis. In addition, the results of these analyses will be used to assist in the indicator chemical selection process.

2.3.3 Indicator Chemical Selection Methodology

In view of the complexity of the SWMUs and Areas of Concern at the facility, it may be inappropriate to attempt to model and review all the chemicals detected in environmental media. Therefore, indicator chemicals will be selected to reduce detected target chemicals to a more manageable number of chemicals for risk assessment purposes. The indicator chemical selection procedure and the initial ranking process will be modeled on the approach described in the Superfund Public Health Evaluation Manual (SPHEM) (EPA, 1986). The objective of this task is to review the analytical database and to identify those site-specific compounds with the highest potential for harm to human health or the environment either as a result of accidental release or as residual occurrences.

Target chemicals detected above local background levels within environmental media associated with each SMWU, Area of Concern, and off-site sampling locations will be ranked and scored by the SPHEM methodology (EPA, 1986). If a target chemical does not exceed local background levels and if there is no known, defined source (such as waste piles, tanks, etc.), then it will be excluded from further consideration.

Whether or not they are above background?

Target chemicals which have a carcinogenic ranking of A, B_1, or B_2 by the Carcinogenic Assessment Group (CAG) of EPA will automatically become indicator chemicals and will be considered separately from target chemicals which are considered to be noncarcinogenic.

what about class C, D?

This approach may not be appropriate where high conc's of Class C, D substances are found.

After this primary selection, the noncarcinogenic target chemicals will be divided into chemical classes based on their structural similarities. An initial ranking of the chemicals in each class will be based principally on chemical-specific toxicity information and medium-specific (i.e., soil, ground water, surface water, or air) concentration data. At the completion of this initial ranking step, chemicals will then be evaluated based on the mobility of the compounds in soil, water, air, and between media, and the persistence and potential transformation

of the compounds detected in the different media. This selection ranking process is modeled on the approach described in the SPHEM (EPA, 1986).

After carrying out this series of toxicity ranking steps, those noncarcinogenic target chemicals that rank high on the list for a given chemical class will be passed to the next phase in the ranking process in which selection will be based on the following information:

- The potential mobility of the compounds detected between soil, water, air, and media using physicochemical properties such as water solubility and volatility;
- The persistence and potential transformation of the compounds detected in the different media;
- The specific functional groups or chemical classes present; and
- The concentration ranges or estimates of chemical masses.

The use of indicator chemicals represents an efficient yet effective method of assessing potential risks associated with mixtures of chemicals. A toxicity profile will be written for each of the selected chemicals of concern. These profiles will summarize the important toxicological information concerning each chemical.

2.4 MIGRATION PATHWAY ANALYSIS

The objectives of this task are to identify site-specific chemical transport pathways and to characterize the media relevant to that transport. The findings will be used to estimate potential exposure of human receptors to site-related chemicals. Site reconnaissance will be conducted by risk evaluation personnel to better understand:

- o Possible migration pathways;
- o Current conditions of the site and surrounding area; and
- o Topography, hydrology, and hydrogeology.

2.4.1 Characterization of Critical Exposure Pathways

Site-related chemicals may be contained in the surface soils. A number of potential migration pathways exist for off-site movement of these site-related materials if in the soil. Off-site migration of chemical waste components may result from ground water movement, surface water runoff, and/or air transport of volatiles and fugitive dust. Compounds that are contained more deeply in the soil matrix may leach or may have leached into ground water, depending on such factors as the permeability and composition of the surrounding geologic strata. The aquifer(s) underlying the facility can potentially transport chemicals to off-site locations and potentially discharge into the Pawtuxet River, which flows into the Pawtuxet Cove.

First, conceptual site-specific models will be developed to qualitatively characterize migration pathways. If necessary, site-specific models will then be developed to quantitatively characterize each migration pathway that may lead to exposure of a receptor. The results will provide input to exposure models in the identification and evaluation of critical exposure pathways.

2.4.2 Media of Concern

The media potentially relevant to each migration pathway will be characterized for its significance at this site. The media to be considered for the facility will include:

- o Ground water;
- o Surface water, especially the Pawtuxet River;

- o Soil on and surrounding the facility;
- o Sediment of the Pawtuxet River; and
- o Air.

During the preparation of the Risk Evaluation the ground water will be characterized for:

- o Aquifer classification by the State of Rhode Island;
- o Aquifer quality and hydrogeological parameters;
- o Aquifer recharge and discharge patterns;
- o Aquifer usage patterns, present and future;
- o Location of actual and potential users of the aquifer; and
- o Evaluation of the potential for discharge of ground water to surface water bodies.

Much of the information concerning the hydrogeology of the site and its surrounding region will be collected during Phase I and Phase II of the Facility Investigation.

Surface water bodies will be characterized for the following:

- o State of Rhode Island stream classification of streams feeding the Pawtuxet River, the Pawtuxet Cove, and outfalls of the Pawtuxet River;

- o Water quality of the Pawtuxet River, upstream and downstream;

- o Flow parameters of the Pawtuxet River and of outfalls of the Pawtuxet River;

- o Uses of the Pawtuxet River and of outfalls of the Pawtuxet River; and

- o Sewer lines, storm drains, and other utilities that may provide conduits for surface water discharges.

Initial review of site data suggests that the Pawtuxet River is the major surface water body of concern for the Risk Evaluation.

The sediment from the surface water bodies of concern will be chemically characterized both upstream and downstream of the site. Sediment transport potential due to storm events and normal river flow will be evaluated as a migration pathway for chemicals to move downstream.

The facility land and the land surrounding the facility will be characterized for:

- o Soil characteristics and topography;
- o Past, present, and future zoning; and
- o Past, present, and potential future land use.

Air will be considered as a potential medium for chemical migration as the Order requires regulatory guideline comparisons, including the use of both state and federal air guidelines.

2.5 EXPOSURE SCENARIO CHARACTERIZATION

The objective of this task is to define the appropriate potential human and environmental receptor populations. Potential exposures for all relevant pathways will be evaluated for human and environmental populations defined by the receptor survey. These potential exposures may result from:

- o Direct inhalation of vapors and particulate-bound chemicals;

- o Ingestion of, or dermal contact with, water or soil containing site-related chemicals; and

- o Ingestion through the food chain.

2.5.1 Population Demographics

Identification of the potential human receptors requires knowledge of the regional demography. A demographic analysis of the region surrounding the facility, including the availability and use of surface and ground water resources, will be conducted. Current demographic records from federal, state, and local agencies will be consulted (including EPA's Graphical Exposure Modeling System (GEMS, 1989) census database), if available, to provide a projection of population changes since the 1980 census study.

In conducting the demographic analysis, special attention will be given to those areas that are hydrologically downgradient or "downwind" from the site. "Downwind" will be defined as the predominant downwind direction determined from the most recent, commercially available meterological data applicable to the site. The size and distribution of off-site populations most likely to be exposed to ground water from the water-bearing system under the site will be estimated using the available demographic data. Similarly, populations that possibly may inhale site-related chemicals will be identified from census tract data. Consideration will also be given to dermal contact with soil or surface water and to exposures through the food chain.

2.5.2 Location of Sensitive Populations

Sensitive populations are those considered to be at greater risk than the typical receptor. Sensitive receptor populations typically include children, the infirmed, and the elderly. The demographic survey will identify potential sensitive receptor locations such as schools, daycare centers, hospitals, nursing

homes, and senior citizen housing. At a minimum, specific receptor locations identified in the Order will be included in the consideration of sensitive populations:

- o Park View Junior High School;
- o Fay Field;
- o Beechmont Recreation Field;
- o Roger Williams Park;
- o Park Avenue Elderly Housing;
- o Cranston General Hospital;
- o Hall Manor Elderly Housing;
- o Scandinavian Nursing Home;
- o Edgewood Highland, Norwood Avenue, and Beechmont Elementary Schools;
- o Sprague Playground;
- o Aldrich Jr. High School; and
- o Christopher Rhodes School.

These areas will be evaluated for the potential for impact due to the possible release of chemicals from the facility.

2.5.3 Environmental Receptors

The approach to characterizing potential environmental receptors is discussed in Section 2.2.2.

2.6 EXPOSURE ASSESSMENT

At each point of potential exposure, the following potential exposure routes will be evaluated for applicability:

- o Inhalation of chemical vapors or particulates released into the air;

- o Ingestion of chemical-containing ground water, soil, or sediment; and

- o Dermal absorption of chemicals from contact with ground water, soil, or sediment.

A screening evaluation of all exposure routes will be made. Those routes that are found to be inconsequential based on the estimated intake, or that appear to be unrealistic based on knowledge of the site, will be documented and dropped from further consideration.

2.6.1 Estimation of Exposure Point Concentrations

The identification and estimation of potential exposure point concentrations for all selected indicator chemicals will be conducted employing health-protective assumptions. In this instance, "health-protective" means that the assumptions, data, and methodologies used will be reasonable but will also bias the risk assessment toward overestimating exposure point concentrations. Estimated exposure point concentrations will be identified for each of the following potential migration pathways when appropriate:

- o Ground water;
- o Surface water;
- o Soil;
- o Sediment; and
- o Air.

More Specific Reference to numerical approaches in SPHEM-

Exposure point concentrations will be identified for both present and assumed future conditions for each media. For on-site locations, exposure point concentrations will be identified through the use of sampling data at that point or will be estimated using verifiable media-specific modeling techniques. The exposure point concentrations described for on-site locations will represent the

ambient concentration (background concentration plus concentrations contributed by the facility).

For off-site locations, exposure point concentrations of indicator chemicals will be measured or modeled to estimate the contribution of the site to ambient concentrations. Background concentrations, generally considered to be concentrations of a chemical found in the sampled media at some point upgradient from the established release point, will be determined on a site-specific basis using predetermined background sampling locations. Those locations will be discussed and described in the Facility Investigation Proposal Addendum.

The identification and estimation of potential exposure point concentrations will be conducted in the following manner:

- Select analytical data representative of actual or potential exposure point concentrations; and

- Estimate exposure point concentrations by using the median or 75th percentile of appropriate data to be representative of concentrations in a given area.

Ground water and surface water modeling may be needed to provide exposure point concentrations. At least one numerical model and possibly several analytical models can be applied using existing site data. The purpose of the models should be to aid in estimating the current and future boundaries of a plume if one exists. Solute transport and receptor point concentrations will be predicted.

Soil and sediment exposure point concentrations will utilize actual sampling data to represent exposure point concentrations. It is not expected that modeling will be necessary for the calculation of the concentrations in soil or sediment.

If the air migration pathway proves to be a relevant and significant pathway, appropriate air dispersion modeling will be conducted to provide an estimate of exposure point concentrations of the indicator chemicals.

2.6.2 Environmental Fate of Indicator Chemicals

Many of the chemicals identified at the facility are known to undergo either anaerobic or aerobic biodegradation as well as photodegradation. The impact of degradation pathways and products will be qualitatively discussed in terms of the potential exposure point concentrations in the relevant media. Discussions will include:

- o The persistence of the indicator chemical in various media;
- o The potential for chemical degradation over time; and
- o The potential for concentration increase over time.

2.6.3 Characterization of Exposure Scenarios

Scenarios will be developed for a range of exposures for applicable chemicals at each exposure point. These exposure scenarios depend on:

- o Migration pathways to the exposure point;
- o Exposure duration at the exposure point;
- o Exposure frequency at the exposure point;
- o Media characterization (e.g., chemical concentration); and
- o Receptor characterization (e.g., ingestion parameters).

A range of exposures will be estimated from the actual and estimated exposure point concentrations of the indicator chemicals. These ranges of exposures will be defined using arithmetic or geometric averages of the media-specific exposure point chemical concentrations. The use of arithmetic means, geometric averages, medians, or percentiles of the media-specific exposure point

chemical concentrations will be decided on the basis of the data distribution. If the data are normally distributed, parametric statistics such as arithmetic means will be used, while skewed data will require the use of order statistics, such as medians, or other forms of nonparametric statistics.

2.6.4 Estimates of Potential Daily Intake

Estimates of potential daily intake will be made using actual or estimated exposure point concentrations combined with the various exposure scenarios described in Section 2.6.3. Assumptions concerning body weight, breathing rate, ingestion rate, soil and dermal transfer rates, and other exposure-related parameters will be derived for the various exposure scenarios. The assumptions will follow the guidelines set forth in the Order, the SPHEM (EPA, 1986), and EPA Region 1 Draft Supplement for Risk Assessment (1989).

Intake estimates for environmental receptors will be specific once any relevant, sensitive, or endangered species are identified.

2.7 RISK CHARACTERIZATION

This section describes the methodology of characterizing noncarcinogenic (chronic, subchronic, and acute) health effects, the estimation of incremental lifetime cancer risk, and environmental impacts due to potential exposure to the indicator chemicals.

As requested in the Order, exposure point concentrations for each site-related chemical at each potential exposure point will be compared to:

- Applicable and relevant exposure standards;
- Health and/or risk-based guidelines or policies (where such guidelines or policies exist); and

- o Proposed guidelines developed in situations where no such standards, guidelines, or policies exist for the site-related chemical; proposed guidelines will only be developed when sufficient toxicological information exists on the chemical.

The total risk for a receptor will be estimated, if appropriate, using the exposure profile defined as part of the risk assessment. Both noncarcinogenic and carcinogenic human health risks will be characterized for each indicator chemical. Evaluation of the indicator chemicals for the effects of potential exposures will also account for evaluation of potential risks posed by the other, less toxic chemicals detected.

2.7.1 Potential Human Health Impacts

The potential for carcinogenic and noncarcinogenic health impacts will be evaluated separately. However, the potential for chemical interactions will be examined closely on the basis of target organ toxicity. For example, when two or more chemicals have similar effects on the same target organ, adding the potential effects is appropriate.

No risk of this pathway in Region 1 residual.

2.7.1.1. Excess Carcinogenic Risk Estimates Site-related chemicals ranked in Class A, B_1, or B_2 as defined by the CAG will be used to estimate incremental lifetime cancer risks based on the receptor's exposure profile. The estimated incremental lifetime cancer risk from individual chemicals on plausible exposure scenarios will be compared relative to the "background" cancer incidence.

2.7.1.2 Noncarcinogenic Health Effects Noncarcinogenic health effects will be characterized by estimating hazard indices (HIs).

HI = Intake at exposure point/reference dose.

An initial screening will be conducted by including all site-related indicator chemicals in one HI. In general, it will be more appropriate to estimate an additive HI group of chemicals with common mechanisms of action or common toxicological endpoints. However, for this assessment, the approach adopted will be to use a total HI of one (1) as the decision point for looking more closely at chemicals for their potential toxic interactions. Based on the decision point, HIs may be calculated for individual chemicals or appropriate chemical mixtures to determine if any might result in a long-term human health impact.

2.7.2 Potential Environmental Impact

This evaluation will be performed using the guidelines outlined in EPA Region 1 Supplement (1989) concerning ecological risk assessments. The potential for adverse effects to the environment will be estimated for the various media and related receptors using the various exposure point concentrations. The bio-assays described in Section 2.2.2 will be used in evaluating the potential for environmental impact due to the potential release of chemicals from the facility. In addition, the on-site observations made during the site reconnaissance described in Section 2.2.2 will be used to address the potential for environmental impacts.

2.7.3 Standards Comparison

A comparison of the exposure concentrations will be made to the appropriate and applicable standards for each media of concern. The following comparisons will be conducted:

- o De Minimus and appropriate excess carcinogenic risk levels;
- o Maximum Contaminant Levels (MCLs) for water quality;
- o National Ambient Air Quality Standards;

- o Drinking Water Quality Standards;
- o National Academy of Science Advisories;
- o World Health Organization Ambient Air Standards;
- o Rhode Island Ambient Air Standards;
- o National Water Quality Criteria; and
- o Proposed guidelines developed in cases where no such standards, guidelines, or policies exist for the site-related chemical; proposed guidelines will be developed when sufficient toxicological information exists concerning the chemical.

2.8 CONCLUSIONS AND RECOMMENDATIONS

Implications of the estimated risks associated with potential exposures will be presented. In drawing conclusions, the following (at a minimum) will be noted:

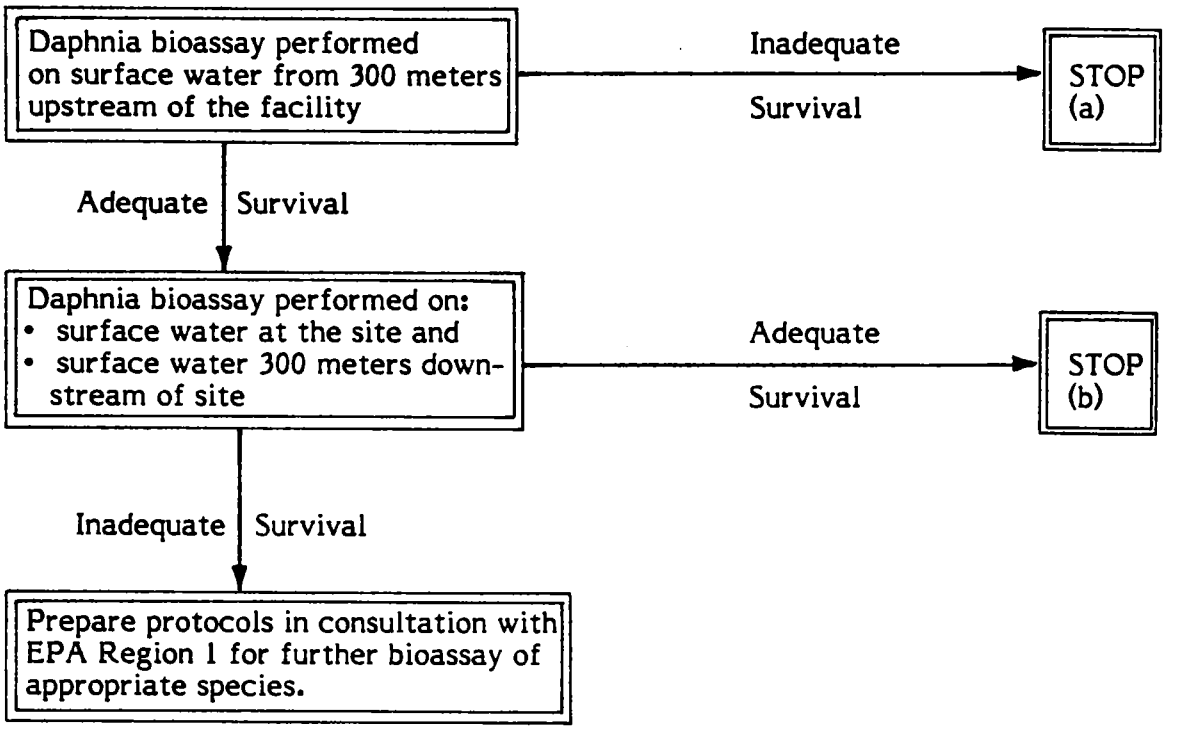
- o Any exposure point concentration which exceeds corresponding standards, guidelines, or policies;
- o The need, if any, for reducing exposure point concentrations and the amount of reduction;
- o An estimation of the potential for human health impact;
- o An estimation of the potential for environmental impact; and
- o Recommended MPS (if necessary).

2.8.1 Uncertainty Analysis

Uncertainities associated with the estimates of risk will at least be addressed qualitatively to provide information on the level of confidence associated with the approaches used. Potential human health risks posed by a defined set of circumstances may be evaluated quantitatively. The precision of these estimates is limited by the size and quality of the database. Often, these limitations can be overcome by defining a range of extremes. Due to the use of these extremes, there are varying degrees of uncertainty associated with estimating the potential risks from chemical exposure. These uncertainties will be compensated for in the risk assessment by making health-protective assumptions, when necessary, that overstate the risk.

Specifically, uncertainty associated with the following areas will be addressed:

- o Receptor populations;
- o Ground water database;
- o Exposure estimates;
- o Toxicological data and risk characterization; and
- o Complex interactions of uncertainty elements.



(a) Testing to stop at this point because the results will indicate that background surface water quality, upstream from the facility, is inadequate for the survival of the test species. Further testing of downstream surface water would not provide additional information concerning the possible impact of potential chemical releases from the facility.

(b) Testing to stop at this point because the results will indicate that the potential for adverse impacts due to possible chemical releases from the facility is unlikely.

Figure 2-1. Tiered Approach for Bioassay

SECTION 3
MEDIA PROTECTION STANDARDS WORK PLAN

3.1 INTRODUCTION

Concurrent with the submission of the RCRA Facility Investigation Report, proposed MPS for indicator chemicals potentially released from any of the SWMUs and/or Areas of Concern will be submitted to EPA in accordance with the Order. The MPS will be used as guidelines for measuring the necessity for and/or the degree of protection afforded by the corrective measures considered in the CMS. Therefore, MPS will be recommended only when an indicator chemical exceeds media-specific state, federal, and/or proposed guidelines, or exceed measured local background chemical concentrations.

3.2 APPROACH TO MEDIA PROTECTION STANDARDS DEVELOPMENT

MPS will not be proposed for every hazardous waste and/or hazardous constituent observed in environmental media. The indicator chemicals are expected to represent the various chemical classes. The MPS proposed for the indicator chemicals will take into account the need to represent a set of chemical compounds with similar toxicological and/or physicochemical properties.

MPS will potentially be defined for each of the following media:

- Air;
- Ground water;
- Surface water; and
- Soil and sediment.

The description of each MPS will include:

- o Data supporting the limits specified;
- o Locations at which the MPS shall be met; and
- o Estimated timeframe for achieving the specified limits.

The guidelines set forth in the Order will be followed for defining the MPS for each indicator chemical. These are:

- o The inclusion of data will justify and support the specified limits;

- o The specified limits will not exceed background levels or limits specified in the Order; and

- o Proposed Alternate Concentration Limits (ACLs) for chemicals will meet the human health-protective requirements established in the Order.

SECTION 4
CORRECTIVE MEASURES RISK EVALUATION WORK PLAN

4.1 INTRODUCTION

If necessary, corrective measure alternatives will be proposed in the CMS. It is necessary to evaluate the human health and environmental impacts of each corrective measure proposed in the CMS. The Risk Evaluation will quantitatively describe current site conditions from a risk perspective. The health and environmental risk models used in the Risk Evaluation will provide the basis for evaluating the proposed corrective measures.

4.2 CORRECTIVE MEASURE ALTERNATIVES EVALUATION - HUMAN

The information collected about chemical releases, routes of exposure, human and environmental exposure points, and the MPS will be used as input for further development of the proposed corrective measures. Each corrective measure will be compared to the MPS in accordance with the guidance of the SPHEM (EPA, 1986) and applying the methodology and site-specific models employed in the Risk Evaluation.

The scope of the corrective measure alternatives evaluation will depend on the results of the Facility Investigation, the Risk Evaluation and the initial alternatives screening. Quantitative assessment of corrective measures will use as much site-specific information as possible. The specific components for each of the SWMUs and Areas of Concern for which corrective measures are to be considered by the alternative evaluation are as follows:

- Exposure assessment;
- Risk-reduction effectiveness;

- Remediation that satisfies existing MPS;
- Remediation that exceeds existing MPS; and
- Remediation that does not meet existing MPS but may nevertheless constitute a satisfactory approach to management of the site.

The corrective measure alternatives evaluation for human health effects will assess the potential for impact at the following locations:

- o Park View Junior High School;
- o Fay Field;
- o Beechmont Recreation Field;
- o Roger Williams Park;
- o Park Avenue Elderly Housing;
- o Cranston General Hospital;
- o Hall Manor Elderly Housing;
- o Scandinavian Nursing Home;
- o Edgewood Highland, Norwood Avenue, and Beechmont Elementary Schools;
- o Sprague Playground;
- o Aldrich Jr. High School; and
- o Christopher Rhodes School.

4.3 CORRECTIVE MEASURE ALTERNATIVES EVALUATION - ENVIRONMENTAL

The environmental assessment performed in the Risk Evaluation will serve as a baseline environmental assessment for the corrective measure alternatives evaluation. The alternative evaluation of the potential environmental effects will help determine which corrective measures will achieve adequate protection where environmental quality is potentially threatened by releases from the facility.

For each corrective measure, the short- and long-term beneficial and adverse effects will be assessed, including potential cross-media impacts. The level of detail in the environmental assessment of each corrective measure will depend on the complexity of the specific area and the considered alternative. The appropriate level of detail will be adequate to meaningfully compare the expected benefits of different corrective measures. Also, the approach will be adequate to determine the extent of impacts of potential remedial operations. Guidelines presented in the Region 1 Supplement for Environmental Assessments (1989) will be used in conducting the environmental assessments of the corrective measures.

Factors generally considered in determining the level of detail include:

- The effects of environmentally sensitive areas;
- Violation of environmental standards;
- Short- and long-term effects; and
- Irreversible commitments of resources (e.g., availability of land for future use).

The following areas will be evaluated for environmental corrective measure alternatives:

- Roger Williams Park;
- All parks or wetlands adjacent to the facility; and
- Pawtuxet River and any connecting downgradient surface waters.

Findings will be presented so that environmental effects of corrective measure alternatives can be compared.

SECTION 5
REFERENCES

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